

JOURNAL OF THE BOMBAY NATURAL HISTORY SOCIETY

1982 APRIL

Vol. 79

No. 1

THE DROUGHT OF 1979-1980 AT THE KEOLADEO GHANA SANCTUARY, BHARATPUR, RAJASTHAN¹

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(With six plates, a map and a text-figure)

INTRODUCTION

Between November 1st 1979 and November 13th 1980 we spent 181 days in the Keoladeo Ghana Sanctuary³. The Sanctuary is near Bharatpur in eastern Rajasthan and is also referred to as Bharatpur Sanctuary, or simply Bharatpur, in these pages.

During our year there we were in the Sanctuary for part of every month. Our purpose was to make a film depicting the wildlife through the seasons. This activity did not allow us to make as detailed observations as we would have liked. However, given Bharatpur's extraordinary interest and the paucity of published material on it, we thought it worthwhile to put our observations on record. The only papers we could find that dealt specifi-

cally with the Sanctuary are by Ali (1953) and Saxena (1975). There is also a bird list by Abdulali and Panday (1978).

Our stay in the Sanctuary coincided with a season of unusual drought as the monsoon rains of 1979 were well below average (see table no. 1). We were also able to witness the regeneration of the plants and animals after the heavy monsoon rains that fell between June and September 1980.

Every day that we were in Bharatpur we kept extensive notes and the following records are drawn from these notes. Most of the observations of nesting birds were made from blinds. For observations on the birds nesting in the two breeding colonies and a few others we used a blind constructed on the top of an aluminium tower that could be raised to a height of up to 7 metres. This blind, because of its light weight, could easily be moved from one place to another and was readily accepted by the birds.

There is one word that recurs throughout

¹ Accepted December 1981.

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³ In 1981 the Sanctuary was declared a National Park and renamed Keoladeo National Park.

this account that could cause confusion. This is the word *bund*. It can mean both an impounded marsh or body of water as well as the actual dike or dam, that retains the water. We have written the word as Bund when it refers to a marsh or lake, e.g. Ram Bund or Cirra Bund. When it refers to a dike or dam we have written it as bund.

THE SANCTUARY

The Sanctuary is essentially an area of semi-arid scrubland, in which, through the aid of a series of canals, sluices and bunds, water is impounded to form extensive marshes. The marshes are sub-divided by a series of tree-lined bunds. The Sanctuary is 29 km² in size.

In a normal season water is fed into these marshes twice a year from Ajan Bund which is located just outside the Sanctuary on its southern side. The first time water is let in is shortly after the onset of the monsoon when enough water from the Gambhir and Banganga Rivers has accumulated in the Bund. This is usually in mid-July, depending on the onset of the monsoon. In 1980 water was let in on July 15th after heavy rain during the second week of that month. Virtually the entire Sanctuary was flooded. The second time water from Ajan Bund enters the Sanctuary is in late September or in October when the Bund is drained ready for the winter cultivation. In 1980 the second allotment of water, which in effect tops up the marshes, was let in on September 29th. Again nearly the whole Sanctuary was flooded.

This system of marshes was first constructed by the then Maharaja of Bharatpur in the 1850's. The refinements of canals, sluice-gates and roads on tree-lined bunds were added in the 1920's or 1930's by the present Maharaja of Bharatpur, now known as Col. Sawai

Brijendra Singh. The purpose of creating these marshes was to improve the duck shooting for the Maharaja and his guests. During this time protection was rigidly enforced and big shoots limited to two or three per season. Royalty and other important persons from around the world shot ducks in Bharatpur in those days. Large numbers of storks, ibises, herons, egrets, cormorants and darters were also attracted to Bharatpur. These birds came during the monsoon months when they nested.

In 1956 the Rajasthan Government took control of the area and it became the Keoladeo Ghana Bird Sanctuary. The Maharaja retained shooting rights until 1972. The last big shoot was held in 1964.

Apart from the marshes, whose area varies according to the time of year, there are extensive tracts of dry land. The vegetation of these dry lands grades from true tall forest, through open woodland, dry scrub and savannah to bare areas of saline soil sparsely dotted with shrubs.

The forest areas, which are small pockets mostly in the NE section of the Sanctuary, are dominated by kalams or kadams (*Mitragyna parvifolia*), jamuns (*Syzygium cuminii*), babul (*Acacia nilotica*) and an occasional neem (*Azadirachta indica*) which was probably introduced. The open woodland is mostly babul with a small proportion of kandi (*Prosopis spicigera*) and ber (*Zizyphus mauritiana*). The scrublands are dominated by ber and kair (*Capparis decidua*). Pилоo (*Salvadora oleoides* and *S. persica*) also occur in the scrubland and are virtually the only woody plants that grow in the areas of saline soil. Saxena (1975) gives a list of plants for Bharatpur. The topography of the Sanctuary is almost uniformly flat.

The Bharatpur Sanctuary has, for its size, an amazing variety of species of birds. To date just over 350 species have been recorded there

KEOLADEO GHANA SANCTUARY

and nearly every year new ones are added to the list. Not only are there many species, but at most times of the year there are vast numbers of birds. The volume and diversity of bird life may be ascribed to several factors. Firstly it is a haven for migratory birds in winter. Secondly, large numbers of birds are attracted to Bharatpur to breed during the monsoon. A third factor is the diversity of habitat, from dense forest to savannah in the dry land areas and from open water to mudflats in the wetlands, all of which support a large population of resident as well as migratory birds. The fourth reason may well be that Bharatpur is the last substantial area of more or less natural, though not undisturbed, habitat in a vast area of the Gangetic plain—an area that once had uncountable numbers of birds (Hume 1881). The birds have become concentrated in this last remnant.

TABLE 1
RAINFALL FIGURES FOR AGRA DISTRICT
(Figures in millimetres)

	1979	1980	Average Rainfall for thirty years 1931—1960
January	12.2	0.0	13.2
February	46.7	4.6	13.5
March	4.8	23.0	8.4
April	2.2	0.3	6.6
May	34.4	9.5	9.1
June	17.5	72.4	51.8
July	133.6	249.3	195.6
August	31.1	290.8	218.2
September	7.2	11.0	133.9
October	4.6	22.0	19.6
November	7.1	1.0	3.3
December	3.0	19.3	5.8
Total	304.4	703.2	679.0

DROUGHT IN 1979

The average annual rainfall for Bharatpur is 662 mm (Saxena 1975). No figures were available for Bharatpur for the years 1979 and

1980. The nearest centre for which reliable rainfall data was available was Agra which is 50 km away by road. The annual average for Agra is 679 mm. There are no topographical or other features that would make the rainfall between the two places significantly different. The figures show that in 1979 Agra (and by inference Bharatpur) received considerably less than half its normal rainfall while in 1980 the rainfall was above average. The rainfall figures for Agra are summarised in Table 1.

The rain that fell during July and August 1979 was not sufficient to fill Ajan Bund and only a small amount of water was let into Bharatpur's marshes during August (Abrar Khan, pers. comm.). No further water was released from Ajan Bund in 1979. The marshes were by no means filled and by November there were only a few gutters of water at Ram Bund, the NW corner of Rauji Bund 1, some water at Sapan Mori and a small area of water on the northern end of Hans Sarovar Bund. The canal between Keoladeo and Sapan Mori was partially filled and Cirra Bund's western half had shallow water in it. Over the months these dried further and further until by March water remained only in the areas where it was pumped from four different bores. The rest was completely dry.

WATER PUMPED FROM BORES

The Rajasthan Forest Department pumped water from four bores (marked bores A, B, C and D on the map) into various parts of the marshes in an effort to maintain water in the Sanctuary. Pumping began in November and December. Pumps B & C were in time discontinued but Pumps A & D worked continuously, when electric power was available, until the beginning of the monsoon. Pump A eventually almost filled Ram Bund and Pump D maintained water in a small por-

tion in the extreme southern part of Cirra Bund. Unfortunately the water from Pump D was not used to maximum effect to safeguard the Siberian Crane during a difficult winter (see under Siberian Crane below).

The primary importance of these flooded areas was to effectively maintain a breeding nucleus of turtles, aquatic snakes, frogs, fish and aquatic invertebrates. All, except the turtles and snakes, are of paramount importance as food species for the large numbers of birds that congregate in the marshes. Migratory and resident birds also benefited greatly from this water (see bird list below).

EFFECTS OF THE 1979 DROUGHT

(1) *Monsoon Nesting Birds*

As in normal years darters, cormorants, egrets, herons and Openbill Storks congregated in the Sanctuary during the latter half of June. Egrets and Openbill Storks began nest-building and some eggs were laid. But when no substantial rains arrived and the marshes were not filled with water from Ajan Bund during July, the birds, abandoned their nests. A few spoonbills and Painted Storks arrived but neither of these species attempted to nest (Abrar Khan, pers. comm.). By September 9th when we visited the Sanctuary the heronries were completely deserted and only a few individuals of the species that normally nest in thousands, were present.

(2) *Migratory & Nomadic Birds in Winter*

The normal complement of ducks that come to Bharatpur in winter were absent. Small numbers of most species were present in November and December, but by mid-January most had left. Only the Ruddy Shelduck stayed in the areas of pumped water, some staying right up to the breaking of the monsoon. Greylag Geese, present in hundreds and at

times thousands during normal winters, came in only very small numbers during the drought winter. Largest numbers occurred during the autumn and spring migrations. During the first week of March 1980 about 80 of these geese stayed in Ram Bund. Barheaded Geese, by contrast, were present throughout the winter, their numbers fluctuating between 500 and 1200. This species fed, from November till the time they left in mid-March, on the new growth of grass in Ram Bund and the eastern part of Cirra Bund. The new growth was stimulated by water pumped into these places.

During January and early February when the last water was drying up in the canal, in the southern area of Cirra Bund and the northern portion of Hans Sarovar Bund, large numbers of birds gathered there to eat fish, some of them very large, that were concentrated in the shallow water. Only the larger birds, cranes, storks, Grey Herons and pelicans, could catch these fish. The smaller fish, which could have been caught by darters, cormorants and egrets seemed to have disappeared already. The most spectacular invasion of birds that came to catch these large fish were the White Pelicans. During the second half of January about 450 of them were fishing the shallows (for details see the bird list below).

In a normal season the marshes are choked with grasses, sedges and other aquatic vegetation. In the winter of 1979-1980 this vegetation had died back, even before the water had completely dried up. The altered conditions allowed for the invasion of pelicans, which would not be able to fish in areas of dense vegetation. Another change was that there were extensive areas of mud, particularly in Cirra Bund, which attracted large numbers of wading birds such as plovers, sandpipers, godwits, etc. Again this is a group of birds normally scarce in the Sanctuary itself.

The Common Shelduck, and a small number of avocets (never exceeding 12)—rare birds for Bharatpur—were present on the Cirra Bund mudflats till the end of February. The mudflats were favoured by unusually large numbers of roosting Sarus Cranes.

Large fish, left stranded by the receding water and the White Pelicans, were eaten mostly by Spotted Eagles, Ringtailed Fishing Eagles, Marsh Harriers, Black Kites, House Crows, Jungle Crows, Crow-Pheasants, and Whitebreasted Waterhens. We never saw any kind of vulture feeding on the dead and dying fish.

The areas of pumped water were much favoured by Wagtails, especially the Yellow and Yellowheaded on their northward migration during March and April and even during the first week of May.

(3) *Vegetation*

On the dry marshes all vestiges of vegetation disappeared once the water had dried up. The marshes became expanses of bare, cracked soil.

The woodlands were less severely affected. Herbs, grasses and herbaceous climbers had died back and in many places the soil was bare. But in other places, such as the Deer Park and the area south of the nursery, a good cover of grass remained.

Several trees such as the jamuns and capers actually flowered and put on new leaves. The two species of piloo had heavy crops of fruit during March and April which attracted numerous Rosy Starlings on migration. The babul and kadam, by contrast, dropped their leaves during the hot months and did not put on new growth until after the rains arrived. But this is the normal pattern, though the fruiting of the piloo seemed more profuse than usual.

(4) *Spring and Summer Nesting Birds*

General information on breeding seasons is from Ali & Ripley (1968-1974) unless otherwise stated.

For a number of species spring and summer breeding proceeded normally. These included Stone Curlew, Small Green Bee-eater, Hoopoe, Crimsonbreasted Barbet, Mahratta Woodpecker, Black Drongo, Jungle Babbler, Tailor Bird, Purple Sunbird and Yellowthroated Sparrows. Nests of these species were found at times and in numbers as they would in normal seasons.

Some species nested late, though not in noticeably lesser numbers. The Mottled Wood Owl's eggs hatched on the 29th and 30th of March in 1980. In 1981 they hatched in early February as they did in previous years (Abrar Khan, pers. comm.). Roseringed Parakeets were still courting and establishing nesting territories during the first week of March while normally this activity does not go much beyond January. Though the nesting of Green Pigeons is variable, the normal season is March-April. We found three nests of this species and all were completed in May. The nesting season for the Grey Partridge is given as March-September and sporadically in other months. In 1980 we found no nests and saw no young before October 10th. On that day we found two nests and subsequently we saw five pairs with very small chicks. In other years we have seen pairs of this species with small chicks in March and April. The Redwattled Lapwing's nesting season is given as March to September. We found nests, in both the dry areas and in places where water was pumped in, only in May and June. In normal years Indian Rollers nest in Bharatpur in some numbers during March and April (Abrar Khan, pers. comm.). In 1980 we found only one nest during those months, on April 15th.

We found three other nests in June. All had eggs which were subsequently inundated after heavy rains and abandoned.

The Sarus Crane and Spotbill Duck which we have seen nesting in March in seasons following good monsoon rains, were seen nesting only in August and September in 1980, i.e. after the monsoon rains. We found seven nests of Sarus Cranes and two of the Spotbill Duck. Some species normally nesting commonly in the Sanctuary failed to nest at all as far as we were able to establish. The Small Blue Kingfisher was not seen in the Sanctuary between March and June, its normal breeding season. The Goldenbacked Woodpecker, which is a common bird, normally nests in March and April. In 1980 we saw two pairs drilling nest-holes during the second half of June. Both nest-holes were taken over by Brahminy Mynahs. No other nesting activity by these woodpeckers was noted in the Sanctuary. Another normally common nesting bird is the Whitebreasted Kingfisher. Only one pair was seen with fledgelings and this was at flooded Ram Bund on the 22nd of June. The same day two pairs of this species were busy excavating nest-tunnels at Cirra Bund next to the Keoladeo Temple. These nest-tunnels were subsequently flooded.

A pair of White-eared Bulbuls was seen building a nest on 9th of April 1980 and another pair was feeding young in the nest on May 6th. The normal nesting season for this species is given as March to September and "may be influenced by rainfall and consequent food supply". However no nesting activity by this species was noticed during or after the rains.

The Redvented Bulbul on the other hand nested only after the rains came. The first nest was found on 27th of June and the last in early October.

(5) *Turtles*

(i) *Lissemys punctatus*

From the first days we were in Bharatpur in November 1979 we noticed hundreds of these turtles wandering in apparent randomness throughout the Sanctuary. Going by the evidence of large numbers of empty shells, this movement away from the drying marshes must have been going on for some time. Every day we saw turtles wandering out in the open right till the end of May. The peak months were November, February and March. During December and January when it was cooler there were fewer turtles walking about and after March most of the pools had dried up and the wandering turtles were mainly seen around the areas of pumped water at Cirra Bund and Ram Bund. A large proportion of these turtles were killed and eaten by Scavenger Vultures. These birds turned the turtles on their backs and then, by inserting their sharp and narrow beaks under one of the flaps over the rear legs, would begin to eat the reptiles. Once killed, King Vultures, crows and Crow-Pheasants also ate the turtles—but only the Scavenger Vultures could get into the shell and so kill the reptiles. The dried marshes and open woodlands were littered with a thousand or more empty shells.

A great many of these turtles found refuge in the areas of pumped water, and a much smaller number found aestivating sites in the woodlands.

After heavy rain during the latter half of June formed puddles in the woodlands, the turtles emerged from their hiding places and their depleted ranks had to run the gauntlet of Scavenger Vultures once more. Of all the vertebrates, with the exception of the fish, this species of turtle was most severely affected by the drought.

(ii) **Trionyx gangeticus**

This species is strictly aquatic and was never seen wandering in the dry areas. We did not see a single one that had been killed. During a normal season this species is very unobtrusive, usually all that is seen of it is an occasional large head emerging from the water. On three occasions we saw one of these turtles grab a bird from beneath the surface of the water. The birds were a coot, a Little Cormorant and a female Common Teal.

We saw this turtle stranded by the drought for the first time on 30th March 1980. Two individuals were in the last mud left in the canal near Sapan Mori and another across the road in Cirra Bund. We carried the Cirra Bund individual to the water near the Keoladeo Temple. Its carapace measured 71 centimetres along the dorsal surface. This species is able to bury itself in soft mud with remarkable speed. In April these turtles frequently came out of the water and basked in the sun. About 30 individuals of varying sizes were seen around the pool in front of the Keoladeo Temple during this month.

In the same month we often saw them chasing each other in the water; some quite large specimens even jumped clear of the water. On April 2nd a pair appeared to be mating in the shallows. Because of the constant action and dirty water it was difficult to see exactly what was happening.

(iii) **Kachuga tectum**

We saw this species only in the pool in front of the Keoladeo Temple. Every day they could be seen basking on fallen logs. They appeared to be unaffected by the drought.

During March, April and May the Keoladeo pool was a crush of turtles with the above three species jostling for space on logs and a short, narrow bund.

(iv) **Hardella thurgi**

On April 2nd we noticed a different species of turtle wandering in the dry canal near the Keoladeo Temple. It most closely resembled *K. tectum*, but was larger and did not have the "saw" pattern on its carapace. Its carapace, measured 48 centimetres lengthwise and 43 centimetres across (along its dorsal surface). We photographed it from all angles and it was later identified by Romulus Whitaker. This was the only live specimen we saw of this species, though we did find a number of bleached carapaces in the dry lake bed just to the southwest of the Keoladeo Temple.

END OF THE DROUGHT AND THE 1980 MONSOON

Since the middle of May birds that nest in Bharatpur's marshes during the monsoon had come in increasing numbers. First to arrive, and in breeding plumage, were Cattle Egrets and Pond Herons. They were first seen on 6th of May. As the time of the monsoon drew nearer more and more birds arrived, though there was no noticeable change in the weather. Even on June 15th there were dust storms sweeping across the dry and desolated marshes and woodlands. But by that time four species of egrets, Pond Herons, two species of jacanas, two species of cormorants, darters and Open-bill Storks had flocked to the Sanctuary. Mostly they were in the areas of Ram Bund and Cirra Bund that had been filled with water by pumping. Spotbill Ducks, Cotton Teal and Comb Ducks had also arrived after a long absence. Spoonbills and Painted Storks were present in very small numbers and were not part of the early influx.

On June 21st the first rain fell. It was cool and humid. Egrets and Pond Herons were scattered across the dark, wet soil picking up insects and other invertebrates forced to the surface by the rain.

Pheasant-tailed Jaçanas were calling everywhere. The monsoon broke on June 27th with a heavy downpour. The woodlands flooded and small pools formed on the marshes. New green growth appeared within days. Turtles emerged from their aestivating places and were sitting in puddles formed in the woodlands. From the 27th of June onwards there was some rain nearly every day for several weeks (see table no. 1 for rainfall). Sunshine was brief and infrequent. The marshes began filling slowly but remained shallow until the second half of July when water was let in from Ajan Bund.

About a week before that date egrets, darters, cormorants and Openbill Storks had begun displaying and nest-building in the breeding colonies in Rauji Bund 1 and at Sapan Mori. The Openbill Storks were the first to complete nests, closely followed by egrets, cormorants and darters. The egrets did not, at first, include Cattle Egrets. They did not nest inside the Sanctuary until early August and then only in the Sapan Mori Colony. This species, however, was nesting at the Bharatpur Railway Station as early as 13th July. Spoonbills, Painted Storks and Large Cormorants did not arrive in numbers and begin nesting in the Sanctuary until the middle of August, by which time the marshes had completely filled.

By far the greatest change took place in the woodlands, particularly during June and July when nearly every day was overcast and rains were frequent and heavy. Trees and shrubs put on new leaf and many flowered. The ground was covered with fresh new grasses and a multitude of herbs sprang up. Many different kinds of vines grew quickly and wrapped themselves around the scrubby trees. Fungi of many different kinds appeared everywhere. Insects and other invertebrates, especially millipedes, proliferated. For a few months

the Bharatpur woodlands looked more like sub-tropical forest than semi-arid scrubland. But in September once the rains became less frequent and there were long periods of hot sunshine, the herbs and vines began to die back and the fungi dried up.

The most dramatic development, however, was the re-appearance of fish. We first noticed small fishes, only a few centimetres long, on July 29th in most of the marshes. By the first week of September certain parts of the Sanctuary, such as the canal, the areas between Sapan Mori and Bakalaya and the northern parts of Rauji Bund 1, at times seemed almost solid with fingerling fish swimming close to the surface. Birds, mostly cormorants, darters and egrets, fed on these fishes in huge, milling flocks. How the fish could breed up on such a gigantic scale after the severe drought remains a mystery. Some fish, though comparatively few, remained in the areas where water was pumped. We also noticed that fingerling fish came in the water from Ajan Bund. But the River Gambhir and Banganga, which feed into Ajan Bund, were also completely dry (Abrar Khan, pers. comm.) though it is possible that a few, small pools remained. But it seemed hardly enough to account for the phenomenal resurgence of numbers. When Ajan Bund was drained in late September, fields between the Bund and the Sanctuary that had been flooded, were covered with small fish when the water receded. Fishermen took several tonnes of small fishes out of the patches of water that remained after the dam had been drained. Unfortunately we were unable to identify any of the fish.

MAMMALS

The following are our more interesting observations on Bharatpur mammals.

Felis viverrina

FISHING CAT

In March, when the last water in the canal at Sapan Mori was drying up, we saw one and sometimes two Fishing Cats there nearly every evening. Once the canal had dried we did not see any more Fishing Cats, before or after the monsoon.

Paradoxurus hermaphroditus

COMMON PALM CIVET

On 27th April 1980 we had a good view of this civet at night by the light of a strong torch, at Bakalaya.

Herpestes edwardsi

COMMON MONGOOSE

On 30th June we saw this mongoose with a newly caught, quite large water snake at Bakalaya. The snake had coiled itself around the mongoose's body in its struggle to escape.

Hyaena hyaena

STRIPED HYENA

At about 8.15 p.m. on July 14th we clearly saw a hyena on the main road just north of the Forest Lodge. This species had not been seen in the Sanctuary for some years.

Lutra perspicillata

SMOOTH INDIAN OTTER

On April 1st 1980 we saw a pair of these otters with three small young sunbathing on a raised mound in Ram Bund. The animals were lying on their backs in the burning mid-day sun.

BIRDS

The notes below are not meant to be an exhaustive list of the birds we observed in the Sanctuary. Rather they record species and incidents of interest with special reference to

the 1979-1980 drought. New records for the Sanctuary are marked NR and new breeding records as NBR. To date only Saxena (1975) has recorded breeding species. Most of the new breeding records we noted are of birds that nest during the summer and monsoon and are quite obvious. It is just that few observers visit the Sanctuary at that time of the year. In the systematics and nomenclature we have followed Ali & Ripley (1968 to 1974).

Pelecanus onocrotalus

WHITE PELICAN

White Pelicans are not regular visitors to Bharatpur, and some years they do not arrive at all. Abdulali and Panday (1978) list this species as "occasional" and Saxena (1975) as "sporadic". The Spotbilled Pelican (*P. philippensis philippensis*) is a more regular visitor, but in small numbers. The jheels and marshes, while having an abundance of fish, do not suit the pelicans as the dense aquatic vegetation impedes their method of fishing. Because of the drought the aquatic vegetation had died back and the shrinking areas of water had concentrated the fish into a small number of pools.

24th January 1980. We arrived in Bharatpur after an absence of 7 days. White Pelicans had arrived on the 22nd (Abrar Khan, pers. comm.). We counted 114 of these pelicans roosting in a dry part of Cirra Bund.

25th January. The pelicans were fishing in a narrow ditch of water left along the bund itself, about 300 metres from the Keoladeo Temple. They fished in the typical fashion for pelicans, i.e. a semi-circle of the birds would drive the fish to one end of the pool, catch as many as they could and then reverse and drive the fish in the opposite direction. Some of the fish the pelicans caught were very large—we estimated the weight of the largest to be between 2 and 3 kilogrammes.

A pair of Blacknecked Storks tried to drive the pelicans away from the ditch. The storks had a large young with them which, although already changing to the iridescent plumage of the adult, still begged constantly for food; incessantly peeping and crouching while loosely flapping its wings. The storks, particularly the male (dk brown iris), would circle low over the flock of pelicans and stab down at them with his beak. The female stork (bright yellow iris) more often threatened by walking straight at the swimming pelicans, her neck low and beak snapping. The pelicans kept their distance and after an hour or so would fly off to roost. But they came back again and again.

26th January. In the morning the pelicans were fishing in the canal between Sapan Mori and the Keoladeo Temple. The water was very shallow and the pelicans half-swam, half-waded in some places. Some of the fish the birds caught were too large for them to swallow and they disgorged them. Many of these fish died and were seen floating in the water or cast up on the mud banks. The largest of these disgorged fish we found was a catfish measuring exactly 80 centimetres in length. Its sides were deeply scored by the pelicans' beaks. The dead and dying fish were eaten by Spotted Eagles, Ringtailed Fishing Eagles, Black Kites, House Crows, Jungle Crows, Crow-Pheasants and Whitebreasted Waterhens.

28th January. The number of White Pelicans had increased considerably in the last few days. They were very difficult to count as they constantly moved from one end of the canal to the other. We counted, as best we could, a minimum of 450.

At 20.30 hours the pelicans were fishing in the canal in bright moonlight. Their fishing time was limited during the day as the remaining water was near roads where the birds were

disturbed from about 8.00 hours onwards every morning by passersby.

16th February. Returned to Bharatpur after an absence of 15 days. Only one White Pelican remained. Abrar Khan told us that the pelicans had left on 9th February, when the areas of water in the canal and in Cirra Bund had dried up. There were very few fish left.

Pelecanus philippensis crispus

DALMATION PELICAN

29th January 1980. Identified two Dalmation Pelicans in a flock of soaring White Pelicans.

Anhinga rufa

DARTER

18th June 1980. A flock of 57 Darters arrived, though the only significant water remaining was in Ram Bund.

11th July. Noticed first nests being built at Rauji Bund 1 breeding colony.

14th August. A tree with nests of Little Cormorants and darters at the Sapan Mori colony had fallen over and died. Most nests were destroyed, but one darter with medium-sized young managed to restructure its nest and keep it going. The nest was only a few centimetres above water level.

4th September. Two still downy white chicks in a darter's nest under observation begged incessantly. The parents when on the nest without further food for the young turned their heads away, resting them on their backs, to discourage food begging. When begging for food the young do so with beaks closed, ready to insert their beaks into those of their parents. Later in the day when it was hot, as early as 8.30 hours, the chicks begged with beaks wide open. When this occurred we saw the adult take off, fly a half-circle around the nest tree, land in some open water, dip its beak into the water (without diving) and return to the nest. It then gave copious supplies of water

to each chick by inserting its beak a short way into that of the young.

21st September. Young in nests in the Rauji Bund 1 breeding colony were now very large. Wings and tails were fully formed but backs and chests were still partially covered in down. Most young left the nest and clambered to the tops of the nest trees, their necks snaking above the foliage. When a parent landed near its brood (the maximum number of young per nest was four) it was immediately besieged, almost smothered, by the young.

October. Observed many young darters (distinguishable by their brown colour and pale necks) fishing in the canal. They are experts at catching fish, surfacing time and again with prey stabbed through with their beaks. But more often than not they lost their catch when juggling it to the tips of their beaks or tossing it in the air to swallow. We never saw an adult lose its prey in this manner.

Ardea cinerea

GREY HERON

11th July 1980. Birds in breeding colours of bright orange-red beaks and orange-yellow legs and feet, gathered in pairs at the Sapan Mori breeding colony. There were no nesting birds at the Rauji Bund 1 colony a place where they nested in 1978.

26th July. Courtship of herons was in full progress. Nest building had already begun. Observed mating frequently. It was accompanied by loud squawks. The males flew off to get nesting material, the females remained on the nest and placed the sticks in place, occasionally with help from the male especially if the stick was a large one. When the male arrived at the nest the pair greeted each other with feathers raised, their crests standing straight up, then bowed to each other by bending the joints at the tops of the tarsi.

29th August. Not many pairs managed to

hatch their eggs. House Crows took a heavy toll. The birds are shyer than the other species in the colony and are easily disturbed, leaving their nests for long periods. Many pairs re-nested in a grove of babul trees across the bund in Rauji Bund 2 (see map) where they raised their young unmolested in the company of nesting Purple Herons.

Ardea purpurea

PURPLE HERON

Of all the normally resident Ciconiiformids the Purple Herons were the first to leave the Sanctuary because of the drought. By the end of November 1979 when the tall grasses and reeds of their preferred habitat had died back, they had left. In the last week of February the Forest Department had begun pumping water into Ram Bund. By the end of March this had resulted in the re-growing of tall reeds and on 2nd April 1980 two Purple Herons had returned. Between that date and early June there were always a few Purple Herons there. By June 18th their numbers began to increase until by 27th June, the date of the arrival of the monsoon, there were about 30 birds. They were in fresh new plumage.

18th July 1980. Birds sitting in pairs in the reeds.

29th July. Birds displaying in the reeds.

1st August. Went out by boat for a closer look at the nesting birds. We found a loose colony of 13 nests varying from those being built to ones with clutches of four eggs. The nests were built of sticks and lined with reeds and placed in clumps of reeds about 25 centimetres above the water.

13th August. The water intake into Ram Bund (since 15th July water had been let into the Sanctuary from Ajan Bund) was not controlled and all Purple Heron nests (as well as those of other species) were submerged and the reed beds abandoned as a heronry.

14th August. Birds were building nests in a patch of babul trees in Rauji Bund 2 not far from Sapan Mori, and some time later they were joined by nesting Grey Herons.

Ardeola grayii

INDIAN POND HERON

A few birds were already in breeding plumage by 26th April and by 11th May all birds had changed. Did not find one pair nesting in the Sanctuary and birds were quite scarce during the breeding season. Only during the winter months were they numerous, presumably when suitable habitat outside the Sanctuary had dried up.

Bubulcus ibis

CATTLE EGRET

Since the beginning of May Cattle Egrets in breeding plumage had been arriving at the Sanctuary. Like all the other marsh birds they congregated in the two places where water was being pumped.

15th June 1980. There was a sudden influx of hundreds of Cattle Egrets. They stood about in the marshy areas. Very hot day, 43°C at Agra,⁴ and all day a dust storm blew.

18th July. Saw the traditional nesting colony in a large neem tree at Bharatpur Railway Station. About 50 nests in the tree. Most nests were in branches overhanging a platform and the tracks. Passing trains actually brushed the lower branches on which nests were built. The platform was busy and noisy but the activity was totally ignored by birds only two to five metres above the crowd. Some pairs were courting and mating. These pairs had bright orange-red beaks and facial and orbital skins. Their irises were blood-red. The birds sitting on eggs, which were in the majority, had pale-

⁴ The nearest place for which temperature figures were available.

yellow irises and yellowish beaks and facial skins.

12th August. Scores of pairs began nesting in the Sapan Mori colony. None nested at the Rauji Bund 1 colony, where small numbers nested in 1978.

Ardea alba

LARGE EGRET

27th June 1980. There had been intermittent rain the previous week and egrets had been returning in increasing numbers. Today a milling multitude of all species of egrets except the Cattle Egret were fishing in the area of pumped water in Ram Bund, close to the western bund. Although all the species arrived in breeding plumage today we noticed the bright facial skin and leg colours of the Large Egrets for the first time. Of all the egrets the Large Egrets were the least in number.

11th July. A few pairs were displaying at the Rauji Bund 1 breeding colony.

26th July. All Large Egrets have left the Rauji Bund 1 colony. Courtship of a small number of pairs has begun at the Sapan Mori colony. Observed a tree of courting and nesting egrets from a tower-blind on the eastern side of the colony. One pair was building a nest about 15 metres from the blind but in a place where the actual nest was hidden from view. It was noticeable that the colour on the facial skin, orbital skin and on the tibia was beginning to fade. Courting Large Egrets had facial and orbital skin of bright turquoise and the tibia and the upper parts of the tarsi were carmine red. These colours were brightest during the days of courtship and faded rapidly once pair bonds had been established. Even the day after a pair had completed its courtship and had begun nest-building the colours started to fade. Before courtship the colours, although present, were not as bright as during courtship itself.

29th July. Entered the tower-blind, still situated in the same place as on 26th July, at 5.00 hours. At about 5.30 hours a Large Egret landed in a prominent spot five metres up in the babul tree. The bird began to display. In one continuous action it stretched its neck fully forward to peck at or grab hold of a branch, raised its plumes, spread its wings and bowed by bending its tarsal joints. Another ritual was a "wing shuffle" whereby the bird, with feathers fluffed, would in a fairly rapid motion flick its wings forward (but not out) in alternate "strokes". The effect of this action, with plumes half raised, is to see the bird shimmering. In a third display the bird opened a wing slightly and ran its beak along the edge of the primaries. This action was performed with either wing. All three displays were of approximately the same frequency with the "neck stretch" performed perhaps slightly more often. Pauses between displays were very short and the impression was one of continuous motion. At all times the back plumes were half raised, only during the "neck stretch" were they fully raised. The "neck stretch" seemed incipient nest-building as the action of the beak was similar to that of a bird placing a stick when building. The other actions are modified preening actions, though they were performed too regularly and too perfunctorily to be actual preening.

We noticed that seven Large Egrets were perched in the tree close to the displaying bird and were watching it closely. During our observations (stopped at 9.15 hours because of fierce lightning approaching the aluminium tower-blind) four of these watching birds one after another joined the displaying egret on his display platform. The two would briefly preen the plumes on each other's backs and then the displaying bird (the male therefore) would mount the bird that had joined it. Mating was attempted with three of the females

without success. After the attempt the male chased the female off by pecking at her. The iris of the displaying male was pale yellow with an orange centre. At least one of the females had her entire iris bright orange. In the nest-building pair observed on 26th July both birds had pale yellow irises. The fourth female was chased off before mating was attempted. All the females were slightly smaller than the male. No nest was built at the place the male displayed. But from those and other observations it appears that the male selects the nest site, displays his colours and plumes in various rituals, attracts a female, the two mate and build a nest at or very near the display area. In nest-building (which was observed on 26th July) all the sticks were brought by the male and placed in position by the female, sometimes helped by the male. This was also observed for median Egrets, Little Egrets, Grey Herons, spoonbills and Painted Storks. In the end very few pairs of Large Egrets nested compared to the number of displaying birds, perhaps because of nest depredations by House Crows. Displays of this species and also of Median and Little Egrets were filmed in some detail and the actions and colours of soft parts are described from notes taken at the time and also from the film.

Egretta intermedia

MEDIAN EGRET

26th July 1980. This species was further advanced with its nesting and many were sitting on eggs. The sitting birds had very pale yellow irises.

One pair right in front of the blind and about 1½ metres lower than the courting Large Egrets of July 29th, was at its selected nest site. Both birds would grab branches of the babul tree and vibrate them as though put-

ting nesting material in place. Twice the pair mated—in silence. In this mating pair the male's iris was dark orange-red, the female's orange. The facial and orbital skins of both birds were lemon-yellow with a greenish tinge on the area immediately in front of the eye. There was more green in the female's facial skin than in that of the male. Their beaks were black. By late morning the male left to collect the first nesting material.

27th July. The pair observed mating on the 26th had progressed considerably with the building of their nest. Their irises were much paler, almost the same colour as those of the birds sitting on eggs.

28th August. Of a pair feeding four small chicks at their nest in the Rauji Bund 1 colony, one had its beak half black and half yellow and the other had its beak two-thirds yellow.

5th September. Nearly all Median Egrets were feeding young and beaks were coloured as for the non-breeding season (see Ali & Ripley, Vol. 1, 1968).

19th September. A Median Egret flew repeatedly to its nest with building material taken from another, abandoned nest. Its partner took the sticks and placed them in position even though the pair had small young.

Egretta garzetta

LITTLE EGRET

11th May 1980. In the company of a dozen Little Egrets was one of a slaty-grey colour. It was uniformly grey except for its face which was white. It had a black beak, black legs and bright yellow feet.

On 26th September we saw a bird of the same description but with breeding plumes exactly like those of the Little Egret, in the Rauji Bund I heronry. We flushed it with Little and Median Egrets from a nesting tree in the centre of the colony. We assumed

it to be nesting, mated with a Little Egret of normal coloured plumage. The bird was particularly shy and as the presumed nesting site was in the centre of the colony it would have caused considerable disruption if we had tried to find the nest. So we did not pursue the matter further. We think the bird in question to be a melanistic Little Egret rather than a slaty-grey phase of the Indian Reef Heron (*Egretta gularis*) as only the face was white and the beak was all black. The grey phase of *E. gularis* has a white throat and foreneck and a largely yellow beak (Ali and Ripley, Vol. 1, 1968).

27th July. This morning two courting pairs were in the babul tree in front of the blind. They were not present on the morning of the 26th. Courting was a bowing with raised plumes with the facial and orbital skins turning coral pink during the display. After the display the colour of the skin would return to a pale greyish colour. There was no change in the colour of the iris. One of the birds had bright orange feet. All the others had yellow feet. There was no change of colour in the facial skin and feet as the season progressed.

29th July. Both pairs that were courting on the 27th were now nest-building. When the male returned with sticks to the nest his face often flushed a coral pink.

18th September. Most egrets already had well-grown young. But we found a nest of a Little Egret with five eggs at the western end of the Rauji Bund 1 heronry. In this nest one egg was nearly ready to hatch and a second was pipping. In a neighbouring tree was a nest of a Median Egret with two eggs. Another nest of the Little species had young almost ready to fledge.

19th September. Entered the blind at about 6.50 hours. Little Egret young still had not

hatched though the cap of the egg was severed nearly all around. The young struggled out of the egg at 10.40 hours. The parents changed over on the nest at 12.45 hours. The new arrival mostly ignored the chick and stood on it for long periods. Eventually the adult discarded the empty egg shells by dropping them over the side of the nest.

20th September. Entered the blind at sunrise shortly after 6.00 hours. The second egg hatched shortly afterwards. The chick that hatched yesterday had dried and was sparsely covered with straggly white down. Many times the parent regurgitated small fishes for the young—but the chicks seemed too weak to pick them up. The parent, after a few moments, reswallowed the fish. Most fish regurgitated were larger than the young.

Mycteria leucocephala

PAINTED STORK

2nd August 1980. Only a few, fewer than 20, Painted Storks were on the marshes. These were the resident birds that had remained in the Sanctuary throughout the dry months. We left Bharatpur for a few days.

12th August. Returned to Bharatpur on the 11th. During our absence an estimated 600-800 Painted Storks had arrived and were now sitting in their chosen nest trees. The breeding colony was scattered and spread over a large area (see map). The birds shunned the Rauji Bund 1 and Sapan Mori breeding colonies except to visit them to pull branches off the babul trees for nesting material. Though Painted Storks have no special breeding plumage (Ali & Ripley, Vol. 1, 1968) the new arrivals were especially colourful, both in their plumage and in their bare parts. The plumage was immaculate, suggesting that the birds had recently moulted. The colour of the iris and bare parts of the breeding birds may be dif-

ferent from that of other times of the year. Ali & Ripley (ibid.) describe the irises of the adults as straw-yellow. Of the birds we examined and photographed closely (well over 50) all except two had either dark brown or medium brown irises. The other two had pale grey-green eyes. Ali & Ripley (ibid.) describe the beak as "orange-yellow, darker and plumbeous at base". The bills of the breeding birds were uniformly orange-yellow without any trace of plumbeous. According to Ali & Ripley (ibid.) the bare skin of the head is orange-yellow. In the breeding birds the heads were bright orange and the throats pink. Some birds had pronounced dewlaps which were pink. The legs and feet were invariably bright pink, a somewhat redder pink than that of the throat and very close to the pink of the secondaries. Ali & Ripley give the leg colour as "brown or fleshy brown, sometimes nearly red". In birds observed and photographed in late January 1980, the colours were as those of the breeding birds, though not quite as bright.

Once the birds had chosen their nest sites they stood there almost constantly. They frequently defecated down their legs. This was a deliberate action. It turned their legs white. They continued this practice till November when nesting ended and it was cooler.

During the rest of August and in early September more and more birds arrived until several thousand pairs were nesting.

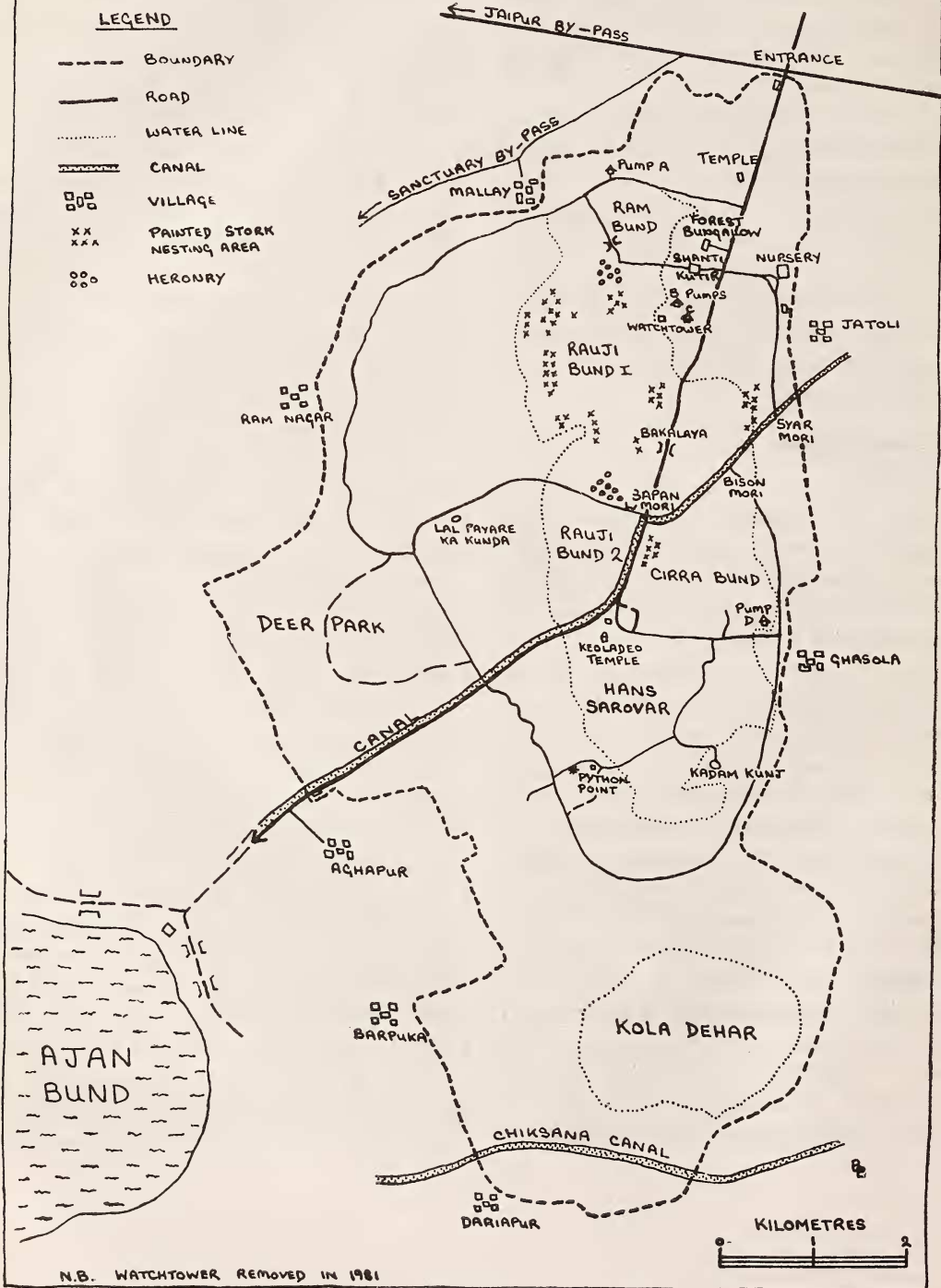
17th August. The first egg had been laid in a nest which is part of a group of four nests in a clump of four babul trees situated on a small mound. The trees, no more than 2½ metres tall, were just to the east of the Rauji Bund 1 heronry, though not part of it. These Painted Storks nests were the first we found and the egg, which must have been laid early in the morning or during the night, was one of the first of the season. On the evening of

KEOLADEO GHANA BIRD SANCTUARY

(AREA: 29 SQUARE KILOMETRES)

LEGEND

- BOUNDARY
- ROAD
- WATER LINE
- ▬▬▬ CANAL
- VILLAGE
- xx PAINTED STORK NESTING AREA
- HERONRY



the 16th August there were no eggs in the nests. We watched these four nests daily till all eggs had been laid and then again almost daily till they hatched to determine their incubation periods. Of the four nests two had clutches of two eggs each and two had clutches of three eggs each. In one of the three-egg nests all eggs failed to hatch and in one of the two-egg nests only one egg hatched. Of the remaining six eggs two hatched after 27 days, two after 28 days and two after 29 days. Time of hatching (observed for four eggs) varied from 10.22 hours to 18.15 hours.

On August 17th our tower-blind was set up facing a group of 22 nest-building pairs in a single spreading babul tree approximately six metres tall. The tree was in Rauji Bund 1 about 300 metres SW of the heronry. Many pairs were busy in mutual preening. Mostly they preened each other's necks by very gently nibbling with their beaks. Sometimes the pair would preen each other simultaneously at other times one would stand with eyes closed while being preened by its partner. Often the pair dozed, one resting its head on the other's back. After a preening session some pairs mated. During mating both birds clattered their beaks individually but also one against the other producing a unique sound. After mating the males set off to gather nesting materials. Nearly always they brought babul branches, some very large up to a metre long, which they pulled off with powerful jerks of their beaks. Mostly they brought green branches but some birds specialised in dry twigs broken off dead, standing trees. Birds arriving on their nests would be greeted with a short burst of beak-clattering and the two would place the twig or branch in place with vibrating movements of their beaks. If the arriving bird did not bring nesting material the pair would greet each other with an "Up-Down"

display as described by Kahl (1970). The loudest and most sustained clattering occurred during disputes, usually over nest sites or over sticks used in nest-building.

20th August. In the large tree observed on 17th August four nests now had one egg each. Two pairs with eggs in their nests, mated. When the day became hot one of a pair would sit on the eggs. Its partner would then spend up to half an hour preening the sitting bird's neck feathers with very gentle nibbling movements of its beak tip.

Once the second egg had been laid the birds spend very little time at the nest together. One would incubate while the other was out feeding. During nest site selection, courting and nest-building both birds were at the nest site or nest all day—sunrise to sunset. This is a period from 4 to 7 days. During this time the birds do not seem to feed unless they feed at night. Nor did we see any Painted Storks feeding in the Sanctuary at that time, though we searched for them.

16th September. The blind was set up at the four nests in the low babul trees near the Rauji Bund 1 heronry. An adult was seated on each nest and remained there till 8.50 hours when all four stood up in quick succession. They preened themselves and then stood with wings spread shading the eggs and young. Nest number one had a day-old young and nest two a two-day old young. These were the first Painted Stork chicks to hatch in the Sanctuary to the best of our knowledge. At 10.18 hours the adult on nest number two fed its chick on lumps of what looked like a yellow-brown paste. The chick ate some and the adult re-swallowed the remainder. At 10.22 hours a chick hatched at nest number one, the adult immediately threw the egg shells over the side of the nest. At 11.00 hours, when we left the blind, the birds were still

standing, shading the eggs and not sitting and incubating. At 6.33 p.m. a young hatched in nest number four.

26th September. At the nests in the low babul trees, nest number one was deserted, we found dead chicks underneath it in the water. At nest number two chicks were growing very rapidly. Both parents were at the nest. One after another the parents went out and collected water in their beaks and presumably their gullets. When they returned they poured copious amounts of water over the chicks (which were still covered in white fluff) and down their throats. Once the chicks were fed on small fishes. The older chick snapped up the regurgitated fish from the parent's beak while the smaller one (there was three days difference in their age) picked up fish from the floor of the nest. Nest number four contained a single young which hatched on August 16th. The parent attending the young regurgitated two very large fish (both without heads), too large for the young to swallow. Time and again the young attempted to swallow the smaller of the two fish, often sprawling on the nest floor with exhaustion with the fish in its beak. Four times the adult regurgitated the two fish and reswallowed them but the young could not swallow either.

A pair of Spotted Munias and a pair of White-throated Munias were busy building nests into the undersides of the Painted Stork nests. Painted Storks were still not seen fishing in the Sanctuary. Birds returning to the nest to feed young came from outside. Those nesting in Rauji Bund 1 nearly all came from due north. They returned in flocks of six to twelve birds and then spread out to individual nests.

18th October. All nests in the low babul trees had fallen when the trees collapsed in a storm. Only one young survived, by crawling

onto the small mound on which the trees stood. By now the young was quite large, almost fully feathered. The parents had built a nest on the mound around the chick, and continued to feed it.

20th October. A lot of Painted Storks had taken up what at first appeared to be nesting territories at both the Sapan Mori and Rauji Bund 1 heronries. They vigorously defended their "territories" and even carried nesting material to them. But there was no courtship and no mating, and no real nests were built. Many of the "nest sites" were occupied by single birds. Before this time Painted Storks came to the heronries only to collect nest-building material.

Anastomus oscitans

OPENBILL STORK

15th June 1980. Day of a dust storm. Bharatpur very dry. Maximum temperature at Agra (nearest centre for which figures are available) was 43°C. Yet several hundred Openbills had arrived and taken up residence in Ram Bund which was green as a result of water being pumped into it from bore A.

26th June. These storks had increased to close to 1000. Numbers of them were standing in the tops of babul trees in Rauji Bund 1 behind Shanti Kutir, pulling at the vegetation and going through the motions of nest-building. They were the first birds to gather in the trees preparatory to breeding. The trees in which they had congregated eventually became the Rauji Bund 1 breeding colony. But in June the marsh here was still completely dry.

11th July. A small amount of water had collected in Rauji Bund 1. Many pairs of Openbills already had finished nests. Until now the birds were black and pure white in plumage. We observed hundreds of Openbills feeding deep in the woodlands well away

from the marshes in areas flooded by recent heavy rain. They were catching snails, frogs and insects.

14th July. Observed a corner of the breeding colony from our tower-blind. The nests had one egg each, the first eggs we had seen. While birds were off their nest due to a disturbance a crow came, broke one of the eggs and ate the contents. When the owner of the nest returned, it picked up the empty egg shells and tossed them over the side of the nest. The nest was not abandoned for at least another two days.

13th August. There had been a considerable decline in the number of Openbill nests since July 19th. But those of egrets, cormorants and darters had increased. All the Openbills had changed colour. The parts that were pure white when the birds arrived were now a dull grey. It would be interesting to determine the mechanism by which the birds' colour changes. We did not notice them moulting. Also the change is uniform and not in patches. The grey colour is the same as that of the young when they fledge. Like the Painted Storks, Openbills were seen showering their nestlings with water during the hot time of the day.

Ciconia nigra

BLACK STORK NR

2nd March 1980. In the afternoon we saw three Black Storks on the dry mud of Cirra Bund. They were seen for only one day. This seems a new record for Bharatpur as it is not listed by either Abdulali and Panday (1978) or Saxena (1975).

Ephippiorhynchus asiaticus

BLACKNECKED STORK

January 1980. See under White Pelican for interaction with that species.

1st April. Observed one catching and killing a Pond Heron. After killing it the stork flew off with the bird and we could not see how or if it ate the Pond Heron.

Anser indicus

BARHEADED GOOSE

17th December 1979. In company of about 50 normal coloured birds we noticed a partial albino. The general impression was of a white bird but closer examination revealed faint traces of the pattern on the head, neck and flanks. Beak, irises, feet and legs were all of normal colour. This bird may have given rise to the rumour that a Snow Goose had been seen in the Sanctuary.

About 500 to 1200 Barheads remained in the Sanctuary throughout the winter, feeding on the growth of grass in areas at Ram Bund and Cirra Bund that were flooded as a result of water pumped from bores A and B. In late March and early April the birds left the Sanctuary. A major exodus occurred on the night between April 1st and 2nd. The last we noticed were a few individuals on 26th April 1980.

Dendrocygna javanica

LESSER WHISTLING TEAL NBR

4th September 1980. A pair with 8 ducklings only a few days old swam close to the blind set up in the western end of the Rauji Bund 1 heronry.

18th September. The pair was still in the same place and still with 8 ducklings.

26th September. Pair with eight ducklings was still in the same area. Two other pairs were close by, one had seven ducklings and the other five all approximately the same age. Today was the first day we could observe all three pairs from the same vantage point.

Tadorna ferruginea

RUDDY SHELDUCK

A few birds stayed right through spring and early summer in the flooded areas. On 26th April there were seven. We saw sixteen on May 17th. The last one, on its own, was in Ram Bund on 15th June 1980.

Tadorna tadorna

COMMON SHELDUCK

We first saw these birds (three) on 17th November 1979. They stayed throughout the winter in the small shallow pools left in Cirra Bund. This species is a rare visitor to Bharatpur. It was first recorded by Sauey in 1977 (Sauey, pers. comm.).

Anas poecilorhyncha

SPOTBILL DUCK

In normal seasons, when the marshes do not dry up, Spotbill Ducks begin nesting in March in Bharatpur (Abrar Khan, pers. comm.) and continue to nest till September-October. No nesting was observed or ducklings seen during the spring of 1980. No Spotbill Ducks were observed, except for the occasional visitor, during April and May.

22nd June 1980. There had been some rain the previous day and several hundred Spotbills had arrived. They congregated in the muddy puddles on Cirra Bund. From this date on there were numbers of Spotbills in the Sanctuary.

4th September. We were shown a nest on a mound in a small marsh on the eastern side of the road between Bakalaya and Sapan Mori. It contained seven eggs. On the day we first saw it the sitting bird was being harassed by a Marsh Harrier in immature plumage. The harrier hovered over the nest, landing periodically near it. Whenever the harrier

landed the duck would rush towards it and drive it off. This meant that the duck rushed from one end of the mound to the other. It would leap up at the raptor as it hovered closely overhead. Occasionally the harrier would fly away, only to return a short while later.

On 6th September we found the nest abandoned and containing broken eggs.

15th September. Another nest on a mound near the watchtower was pointed out to us. It contained 10 eggs.

This nest was also robbed of its eggs. Both nests were discovered by Forest Department labourers clearing the mounds of grass and weeds so that the planted babuls could grow more quickly. Despite the presence of the nests the mounds were cleared, leaving the nests exposed.

Anas querquedula

GARGANEY TEAL

14th May 1980. Three birds in Ram Bund.

15th July. Observed 13 birds in Cirra Bund close to the Keoladeo Temple.

13th August. In late afternoon a flock of about 30 birds flew overhead and then settled in the open water in Ram Bund.

Nettapus coromandelianus

COTTON TEAL

22nd June 1980. These birds had also left during the winter. But on this date, after some rains, many pairs and threesomes were flying fast circuits over the marshes, while vocalising in a rapid quacking call.

17th July. These birds were still engaged in courtship flights. Threesomes were invariably made up of one female and two males. Occasionally they would alight in large trees where the females would inspect possible nestholes. Pairs were often seen perched in trees. In one

threesome the two males fought in mid-air, one male grabbing the other by the neck with his beak. The two crashed into the branches of a babul but soon recovered and flew on after the female, quacking loudly.

22nd September. Checked three nests in hollows in trees besides the Keoladeo Temple. Two nests were in hollows only 1½ metres apart in a jamun tree. One nest contained four ducklings and eight eggs, the other contained five eggs. The third nest was in a babul tree and contained three eggs.

27th September. Saw a female with 17 small, downy ducklings at Sapan Mori, only about 20 metres from the road.

Sarkidiornis melanotos

COMB DUCK

This species also left the Sanctuary during the dry months.

12th August 1980. Found a nest in a hollow limb of a babul along the bund about half a kilometre east of the Keoladeo Temple. It contained 17 eggs. Three of the eggs were very small and about the size of those of a Cotton Teal. Perhaps the Comb Duck had taken over the nest hollow of a Cotton Teal.

27th September. In a flooded field immediately below Ajan Bund we observed a Comb Duck with 17 ducklings at least one week old.

Pernis ptilorhynchus

HONEY BUZZARD

We noticed this bird in the Sanctuary from March 1980 onwards.

22nd June 1980. Abrar Khan showed us a nest he had found. It contained two eggs. The bulky stick nest was 8¼ metres high in a kadam tree. The tree was about 15 metres east of the road and about half a kilometre south of the Shanti Kutir turnoff.

5th July. The nest contained one newly hatched chick and one egg.

7th July. The second egg was pipping.

12th July. The nest was empty except for the fresh carcass of a Pied Mynah, presumably brought by the parents to feed the young. On the 11th we saw an Eagle Owl low in a tree only about 10 metres from the nest. Perhaps it took the young as owl of the genus *Bubo* are known to take the young of other raptors (Newton 1979).

Milvus (migrans) lineatus

BLACKEARED KITE NR

This distinctive subspecies of the Black Kite, with its "conspicuous white buzzard-like underwing patch" (Ali & Ripley, Vol. 1, 1968), is recorded from Delhi by Abdulali and Panday (1978) but not from Bharatpur. It is not listed by Saxena (1975). We saw and filmed two of these kites at Ajan Bund on 17th October 1980.

Aquila clanga

GREATER SPOTTED EAGLE

23rd December 1979. We saw three immature Spotted Eagles on some kind of prey out in the NE corner of Hans Sarovar Bund. The marsh was virtually dry, only a few patches of soft mud remained. We walked over to investigate. One of the eagles was larger than the other two and was feeding. The others stood a little to one side. The bird they were eating was a large owl of the genus *Bubo*. This could be determined from the head, legs and feet which were still intact.

24th December. A Greater Spotted Eagle in immature plumage was feeding on some indeterminate meat. While it was feeding a Sarus Crane walked up to it, approaching to within a few centimetres of the eagle. The eagle raised its hackles, opened its beak wide,

spread its wings and struck out with its talons. After a few minutes the Sarus walked away. 26th December. In Rauji Bund 1, due west of Shanti Kutir we observed an eagle in adult plumage feeding on a dead spoonbill in shallow water.

29th January 1980. Early in the morning an eagle was feeding on a large catfish left stranded in the canal near the Keoladeo Temple by the pelicans. Its bill did not seem suited to fish eating for it could tear off only small pieces of flesh and skin. It fed for more than two hours. This was in sharp contrast to a Ring-tailed Fishing Eagle, which fed on a catfish it had caught. The Fishing Eagle was able to pull off large pieces of flesh and finished its fish in less than 10 minutes.

Haliaeetus leucoryphus

RINGTAILED FISHING EAGLE

For a number of years two pairs have nested in the Sanctuary. One pair in the northern end of Ram Bund the other on the far eastern side of Cirra Bund close to the eastern bund itself. In the winter of 1979-80 the Ram Bund pair did not breed. Frequently we saw them sitting on an old nest, but they used it only as a feeding platform. We did not see the birds carry nesting material, nor were eggs laid. For the previous seven years (Abrar Khan, pers. comm.) the female laid eggs each winter. But not once did the eggs hatch. All the old nests, of which we counted five, are in tall kadam trees on the northern edge of Ram Bund.

5th December 1979. On the evening of December 4th, while driving to Bharatpur, we picked up a hare freshly killed by a truck. On the morning of the 5th we put this out in a conspicuous place in a dry area of Ram Bund, well within view of the female Fishing Eagle. We hoped to film the bird on the hare.

We watched the Eagle from 8.00 hours to 17.00 hours, but she never once left her perch. 13th December. The pair nesting in Cirra Bund had two eggs in their nest. The huge stick nest was in a dead kadam tree at a height of 16½ metres. The tree was about 150 metres from the eastern bund and approximately half way between Bison Mori and the southern bund.

22nd December. At 11.40 hours a Forest Guard climbed up to the nest to check its content. The female eagle did not leave the nest till the guard had climbed to a height of four metres, then she circled low, making clicking noises. The male also came and settled in a nearby tree. The guard reported that there were two young in the nest, white and downy and very small. One young was larger than the other and the smaller one appeared damp. There were two fish, each about 30 centimetres long, on the nest rim. Only small pieces had been eaten. By the time we had walked less than a 100 metres from the nest tree, both birds had returned to the nest.

24th January 1980. Saw parents feed chicks.

26th January. We checked the contents of the nest. It was empty. The adults were sitting in a neighbouring tree. Perhaps the young had been taken by Dusky Horned Owls which are common in the area. According to Newton (1979) owls of the genus *Bubo* are known to take the young of raptors. He reported that most of this predation is on large young no longer covered by the female at night.

17th February. The base of the eagle's nest tree had been deliberately set on fire by herds-men. The huge tree toppled.

This was one of many dead kadam trees cut or burnt down during 1979-80. The wood was taken out within days by herds-men and other villagers. The Fishing Eagles remained in the area.



Above: Male Blacknecked Stork attacks a group of White Pelicans in Cirra Bund. January 1980.

Below: Female Mottled Wood Owl on its nest in a neem tree. Photograph was taken in the daytime. April 1980.

(Photos: Stanley & Belinda Breedon)



Above: Female Mottled Wood Owl feeding its chicks on a Roseringed Parakeet. Photograph was taken at night. April 1980.

Below: Collared Scops Owl feeding young almost ready to fledge. Photographed at night. April 1980.

(Photos: Stanley and Belinda Breeders)

Sometime in late March or early April both pairs of eagles left the Sanctuary.

26th August. A male eagle had returned to Ram Bund.

4th September. A pair of eagles had returned to the eastern side of Cirra Bund.

6th September. The pair had begun building a nest in a tall jamun at Bison Mori.

27th September. The pair built a new nest in the top of a babul tree only about 30 metres from the jamun. They appeared to be brooding eggs. The nest was in too thin branches to climb safely.

17th October. A large (female) Ringtailed Fishing Eagle in immature plumage arrived at Ram Bund. When we left Bharatpur on 13th November she was still there. The adult female, normal resident in this area, had not returned by this date.

Neophron percnopterus ginginianus

INDIAN SCAVENGER VULTURE

From September 1979 onwards the Indian Flapshelled Turtles, *Lissemys punctatus*, left the drying marshes in large numbers. In what seemed a random movement, they wandered off in all directions, keeping walking until they found shelter in the woodlands or areas of pumped water. To reach the shelter of dense vegetation or ground litter they had to walk many kilometres over bare ground. Amongst the birds there was only one predator on these turtles and that was the Scavenger Vulture. These birds would walk up to a turtle, turn it over, and dig underneath one of the rear flaps with its sharp and narrow beak. Only these vultures could open the flaps. Once opened, King Vultures and Whitebacked Vultures would often commandeer the turtle. We saw turtles wandering about and Scavenger Vultures feeding on them till about two weeks

after the rains arrived, i.e. about July 10th 1980.

28th November 1979. A vulture in immature plumage, carrying a stone in its bill, walked up to a turtle lying upside down in a dry marsh and then dropped the stone on the turtle's shell. It was an action very similar to that observed of the Egyptian Vulture (*Neophron p. percnopterus*) in Africa which uses stones to break the eggs of ostriches (Van Lawick-Goodall 1970).

Circus aeruginosus

MARSH HARRIER

We saw the first bird to arrive from migration on August 13th 1980. It was in immature plumage, as were all the birds we saw this season. Apart from taking the eggs from a Spotbill's nest, we saw a harrier take the eggs of a Purple Moorhen (26th September), and a nestling of a Little Cormorant (20th September).

Falco peregrinus

PEREGRINE FALCON

Abdulali & Panday (1978) rate the Peregrine as occasional at Bharatpur and Saxena (1975) considers it rare. Neither list specifies the subspecies. On 26th January 1980 we saw a Peregrine perched in a dead kadam tree in full sunlight and we could approach it closely. With the aid of a friend's powerful telescope we were able to identify it as *F. p. japonensis*. The black cap and moustachial stripes and very pale, almost white, underside were diagnostic.

Grus antigone

SARUS CRANE

In December 1979 there was a tremendous influx of Saruses every evening into Cirra Bund and the NE portion of Hans Sarovar

Bund. The birds began to arrive about an hour before sunset and continued to stream in until dark. Some arrived even after dark. All but a few left again at sunrise.

20th December 1979. We counted the Saruses at 18.05 hours. There were 194 in Cirra Bund and 240 in adjoining Hans Sarovar Bund. This appears to be the largest concentration of Saruses recorded in the Sanctuary (Sálim Ali, pers. comm.).

During March and April 1980 when pumped water began to collect in Ram Bund, the top end of Rauji Bund 1 and Cirra Bund, Saruses remained feeding there all day. Most days there were well over 100 Saruses in both Cirra Bund and Rauji Bund 1. On April 4th, in mid-afternoon we counted 238 Saruses at Cirra Bund alone and on 19th April there were 101 at Rauji Bund 1. On 17th May there were 214 Saruses at Cirra Bund but none at Rauji Bund 1 where pumping had stopped. Water was shrinking at Cirra Bund in the latter part of May as power cuts restricted the pumping. On May 23rd there were only 63 Saruses at Cirra Bund and none at Rauji Bund 1. Once the rains started, on June 21st, the Saruses dispersed and were present in only small numbers.

In good seasons Saruses begin nesting in March, but in 1980 none nested before the rains.

18th July 1980. We watched two different pairs of Saruses build nests in shallow parts of Rauji Bund 1. The birds pulled up grasses and other aquatic vegetation and tossed it into a pile. The effect was to create a small platform surrounded by a narrow moat of water.

13th August. From a distance we saw a Sarus sitting on a treeless mound just NW of the watchtower. The bird appeared to be sitting on a nest. We poled towards it in a boat

and only when we were within a few metres did the bird stand up and walk away. But it was not incubating an egg, it had been sitting on a stone, roughly the size of a Sarus egg. The stone was pale yellow-brown in colour, and pitted with small holes. We watched a pair of Saruses in this same area till early November, but though they built several nests we never found any eggs or saw any chicks.

14th August. Found a nest with two eggs at Bison Mori. On 8th September we observed the nest from a distance. Both parents were there. There were two chicks on the nest—one stood strongly upright. The other was smaller, still wet and still at the tottering stage. One parent carried off some eggshells; the smaller chick must have just hatched. On 15th October we filmed a pair of Sarus with two well grown young at this nest site. Young were still being fed by their parents.

17th August. We found two nests, each with two eggs, in the northernmost portion of Rauji Bund 1. We found the chicks from one of the nests when the chicks were approximately one week old. This was on September 14th.

20th August. We found a nest with one egg about 80 metres west of the main road at a level with the watchtower. We checked this nest daily and the second egg was laid on August 23rd. There is not much information on the incubation period of the Sarus Crane. Ali & Ripley (1968), quoting Lahiri, say it is 28 days. The Moghul Emperor Jahangir states in his memoirs that the eggs hatched after 34 days incubation (Ali 1927). At the International Crane Foundation it was found that Sarus eggs hatch after 30-32 days in an artificial incubator (Sauey, pers. comm.). On September 21st we could hear a chick chipping in each egg and from one we could hear pipping sounds. On 23rd September one egg was pipping at 6.12 hours. At 16.00 hours

KEOLADEO GHANA SANCTUARY

the second egg was pipping and the first egg was almost ready to hatch. We left the nest at 18.30 hours and returned at 19.30 hours by which time the first had hatched. It was full moon. We returned to the blind at 6.00 hours on September 24th. At 6.05 hours both adult Sarus arrived at the nest. The male ate the membrane and eggshell of the egg which hatched the day before. Shortly after 10.00 hours the chick, still unsteady, stumbled off the nest. The male stayed with it and fed it small items very, very gently. At sunrise on September 25th the second egg was almost ready to hatch. The female brooded it while the male stayed close-by with the first chick. When the second egg hatched at 9.40 hours the male joined the female on the nest. Both parents swallowed small portions of the eggshell but the male carried most of the shell and membrane off and dumped them a few metres from the nest. So the first egg hatched in 34 days and the second in 33.

Grus leucogeranus

SIBERIAN CRANE

Of the 14 species of Crane, the Siberian is considered the most endangered by the International Crane Foundation (Sauey, pers. comm.). Once this species occurred over a fairly wide area of northern India (Hume and Marshall 1880). But in recent years Bharatpur Sanctuary has been the only known wintering ground for this species in India. And even during that time there has been a drastic decline in the numbers coming to Bharatpur. Below are the numbers of birds recorded for the Sanctuary for the decade 1970-1980. The figures have been compiled by the International Crane Foundation.

March 1970	— 76	cranes
Winter 1974-75	— 63	„
February 1976	— 61	„

February 1977	— 57	cranes
February 1978	— 55	„
Winter 1978-79	— 41 to 43	„
Winter 1979-80	— 33	„

In spite of the fact that the Siberians are undoubtedly the Sanctuary's most important species, they suffered the worst from the drought of 1979-80. The birds fed almost exclusively at Cirra Bund and, when at Bharatpur, were seen in other locations within the Sanctuary only a few times and usually as a result of a disturbance at Cirra Bund.

Cirra Bund was the last to dry up and with two exceptions the area of soft mud and shallow water within this Bund was the only place the cranes were seen feeding. The other two places were a small pond only a few metres in diameter at Sapan Mori where two of these cranes briefly fed on January 28th 1980, and Ram Bund where a single Siberian stayed from March 18th to 30th.

No matter what the time of day the Siberians were always feeding when we observed them, even during moonlit nights. They spent no extended periods preening. Unison calls and other interactions were extremely rare. The only vocalisations, apart from the very occasional unison calls, were soft calls during flight. Feeding required the expenditure of a great deal of energy, the birds having to move substantial quantities of mud to uncover the small tubers on which they fed. The tubers were not as numerous as in normal years.

The drying up of Cirra Bund, the only place in the Sanctuary the cranes could feed, meant that the birds were disturbed quite often by herdsmen and also by tourists. Neither the herdsmen and their buffaloes nor the tourists were effectively controlled by the Sanctuary management. Whenever the cranes were disturbed they would circle over the Bund for a few minutes or sometimes for several hours

and then invariably fly off to a destination outside the Sanctuary. Often the cranes left the Sanctuary for many days on end. It was never discovered where they went.

Water pumped into Cirra Bund from pump C was for some reason directed towards the eastern portion only, an area devoid of Siberian Crane food.

The conditions for the cranes and their behaviour during the 1979 drought was very different to that in a normal season. We observed this species in January 1975 and again in February 1977. In both these winters there was enough area of marsh so that the cranes, if disturbed (which happened rarely), could move to another area. They never left the Sanctuary. Food was plentiful in all the major Bunds. The birds interacted frequently and their unison calls were heard daily and often. They spent long periods preening.

The first Siberian Cranes arrived on December 7th 1979. Four of the birds arrived that day. By December 15th twelve cranes were at Cirra Bund including one juvenile. On 18th December all twelve cranes flew off at 14.00 hours. One returned at 16.00 hours. On 19th December seven cranes arrived—two at 9.00 hours, two at 11.56 hours and three (including a juvenile) at 12.00 hours.

On December 20th and 21st there were eight cranes all day. On the 22nd the eight cranes were joined by a further two at 16.50 hours. On 23rd December the cranes were disturbed at 9.20 hours by a tourist and flew up but all returned by 10.00 hours. Two more Siberian arrived between 15.30 hours and 16.30 hours. On December 25th only eight cranes remained and all of these took off in a NW direction in the afternoon of December 26th.

We were absent from Bharatpur from December 27th 1979 to January 7th 1980. On the morning of January 8th 33 Siberian

Cranes were recorded (Abrar Khan, pers. comm.), but that afternoon, when we arrived only 16 were left, including three juveniles. The morning of January 8th was the only occasion during the whole winter that all 33 cranes were seen in the Sanctuary. On January 14th we saw 28 Siberian Cranes, but this was the only occasion we saw that many. There were no cranes on January 17th. On January 24th and 25th there was one pair. On the morning of January 26th the pair was joined by another pair accompanied by a juvenile. One of the new-comers squatted down and slept with its head resting on its back. The other fed and the young just gazed around. This trio left again on January 27th. On January 28th the "resident" pair were joined by another pair. At about midday both pairs were disturbed by a herdsman and left the Sanctuary. We were absent from Bharatpur from February 1st to 16th. On the 16th only one pair was in the Sanctuary. According to Abrar Khan these two cranes were present nearly all the time we were away. On February 11th they were joined by six others (Abrar Khan, pers. comm.)—two pairs, each with a juvenile—but they only stayed a few hours. The "resident" pair left on February 28th 1980. According to Abrar Khan six Siberian Cranes arrived on the evening of March 3rd and left again at 9.30 hours on March 4th. From March 18th to 30th a single Siberian Crane stayed in Ram Bund and then left the Sanctuary.

Porzana pusilla

BAILLON'S CRAKE

We first noticed this species on August 19th 1980 and saw it regularly after that. Although we looked for nests when flushing the bird, we never found one. We always saw it on the

aquatic vegetation such as grasses and water-lilies while we were out in a boat.

Amaurornis akool

BROWN CRAKE NR

We first identified this bird in the Sanctuary on 17th November 1979 and saw it regularly until the breaking of the monsoon. We did not see it after that. Neither Abdulali and Panday (1978) nor Saxena (1975) list this species for Bharatpur.

Amaurornis phoenicurus

WHITEBREASTED WATERHEN

At dusk on August 19th we observed a Whitebreasted Waterhen leading its chicks from a bund out on to the marsh. The adult folded some grasses over to form a platform after which it fluffed itself out and brooded the four small, black and downy young.

Porphyrio porphyrio

PURPLE MOORHEN

There were no Purple Moorhens observed during the winter, spring and early summer. We first noticed this species in very small numbers at Ram Bund on June 18th. On July 18th pairs were busy courting and making nest-platforms by bending the reeds. By 24th of July there had been a big increase in numbers in all parts of the marshes. We found five nests in Ram Bund on August 1st, the number of eggs varied from two to five per nest. All these nests were built in tall reeds. By 13th August the nests were submerged as a result of water let into Ram Bund from Ajan Bund. Between 17th August and 15th September we found nine more nests. Completed clutches varied from four to seven. All these nests were in aquatic grass in the area west of the watchtower in Rauji Bund 1.

Hydrophasianus chirurgus

PHEASANT-TAILED JAÇANA

We spotted the first jacana in breeding plumage on May 9th 1980 in the green grassy area around pump D in Cirra Bund. Large numbers arrived in early June when scores of pairs were calling in Cirra Bund, Ram Bund and Rauji Bund 1. We saw a loose congregation of 35 in Ram Bund on 22nd June. By June 25th numbers were fewer throughout the Sanctuary; perhaps 30 pairs where before there had been several hundred individuals. On July 19th we observed a nest from a blind. The nest was out in the marsh 12 metres from the northern bund of Ram Bund. Our observations began at 16.00 hours and lasted for about two hours. The floating nest was in the open water so the bird could not walk to it, but had to fly. When it first arrived the bird was wet from wading in some damp grass. Before settling on the four eggs the bird removed the water drops from its underside with sweeps with its beak. Then the bird incubated the eggs by scooping them under itself with its wings. The wings were between the eggs and the damp surface of the nest. The spurs on the bird's carpal joints were clearly visible. Between 1st August and 15th September we found six more nests—all of them in Ram Bund and the northern edge of Rauji Bund 1.

Metopidius indicus

BRONZEWINGED JAÇANA

Like the Pheasant-tailed Jacana, this species was absent from the Sanctuary from December onwards. We noticed the first arrival on June 18th, a single bird. This species was not nearly as numerous as the Pheasant-tailed Jacana, nor was it as vocal. We found the first nest of this species on August 1st in the southern part of

Ram Bund. It contained one egg. When we next visited the nest on August 13th there were four eggs. The nest was a densely packed, floating mass of aquatic vegetation in a patch of sparsely spaced reeds. It seemed to be loosely anchored for the nest would float only a few centimetres whenever a breeze sprang up. The nests of both species of jacana, which were subject to the same rising waters as those of the Purple Moorhens, were not inundated.

The following are observations on the nest we first found on August 1st—

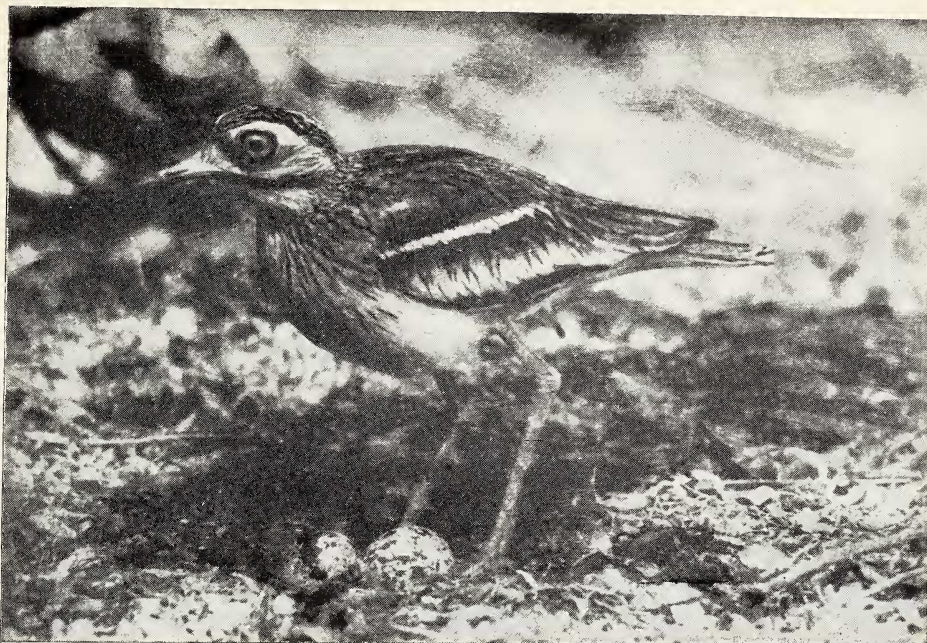
25th August, 1980. One egg had disappeared from the nest.

28th August. Checked the nest at 8.32 hours and two eggs were pipping. Stayed in the blind overlooking the nest till 12.25 hours. During that time the bird rushed off the nest twice to distract a House Crow that had perched in a babul tree about 30 metres away. In each case the jacana took off with such force that an egg rolled off the nest. When it returned the bird rolled the egg back onto the nest with its beak. Like the Pheasant-tailed Jacana, this species scoops the eggs underneath itself with its wings when settling down to incubate.

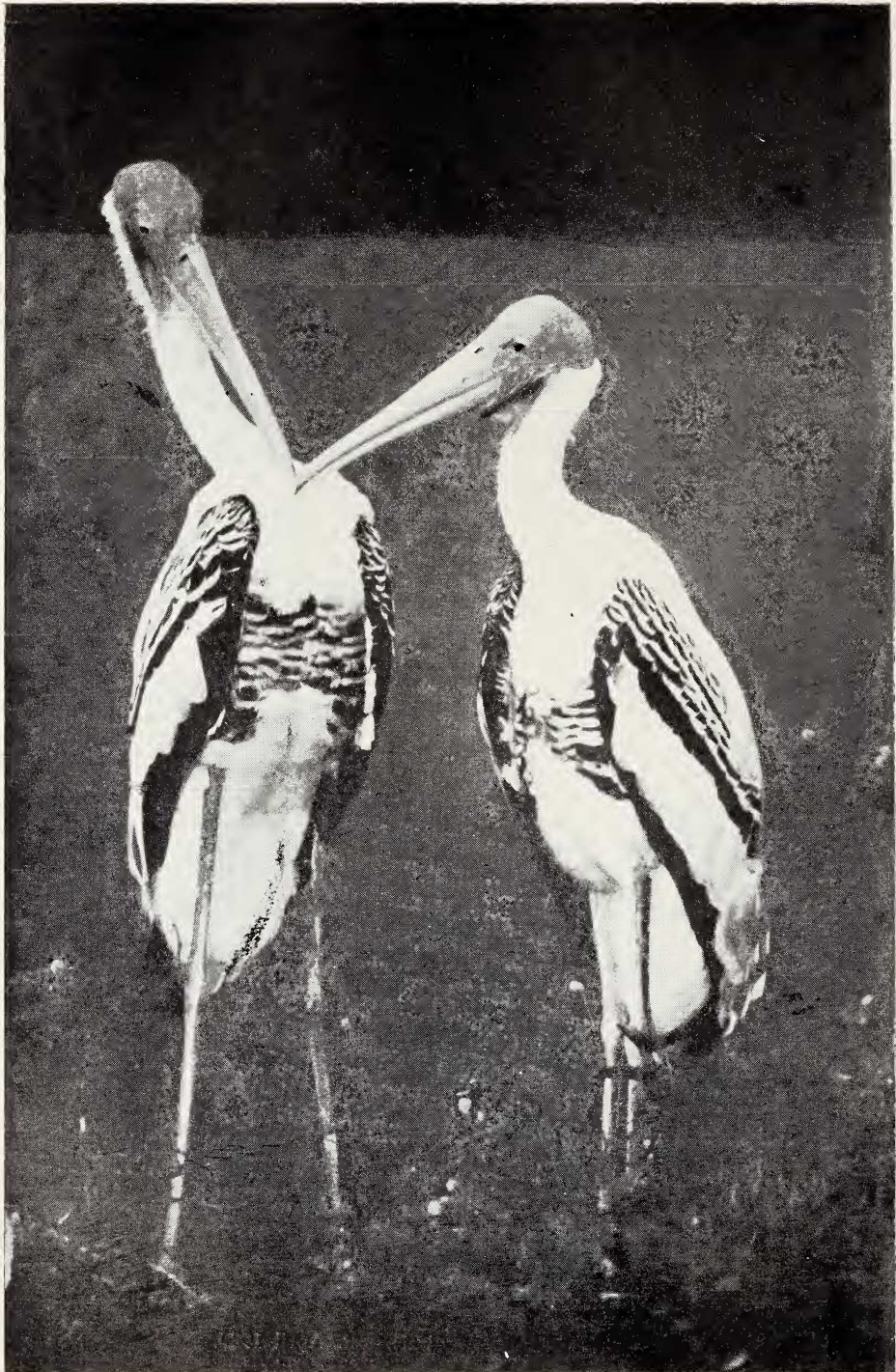
29th August. Arrived at the blind at 6.00 hours. The bird did not get off the nest as I entered the blind. The bird gave a call we had not heard before, a very soft "preeow, preeow" with the beak barely opened. The eggs had not yet hatched at 6.20 hours. We went back to the nest at 8.15 hours and found that one egg was nearly ready to hatch, we could hear the chick peeping. Perhaps the adult's new call was in response to the peeping of the chick. The chick hatched at 8.37 hours. The sitting bird, presumably the male, raised himself slightly and the hatchling tottered towards him and while still wet pushed underneath one of the adult's wings, lodging between his body and the wing. At 8.53 hours

the male stood up, gently opened his wing and dropped the young, he ate a few small fragments of egg shell and took the larger pieces of shell away. When he returned the chick squirmed back under one of the male's wings. The male called softly all the while and held his wings slightly open. The male left the nest four more times before 10.14 hours when we left the blind. Each time the young was gently dropped and each time the adult returned it struggled back under one of his wings.

30th August. Arrived at the blind 6.04 hours. At 6.07 hours the jacana stood up briefly, the long pink legs and feet of a chick dangled from under each wing. The third egg had not yet hatched. At 6.15 hours the male suddenly flew off the nest dropping the two young. One landed in the water where it stayed "frozen" until the parent returned at 6.22 hours, then both young rushed to him and pushed one under each wing. At 6.31 hours the male tucked the egg under himself. From 6.39 hours onwards the adult no longer sat on the egg but rested on his tarsi when on the nest. The young occasionally squirmed out from under the male's wings and foraged around the nest. Three times in quick succession the male rushed off the nest end, screeching loudly chased another, larger Bronzewinged Jacana, presumably a female. At 8.40 hours the male ran off taking a young under each wing with him. The male stood on floating aquatic plants about six metres from the nest. At 8.46 hours the male dropped the young to chase another BW Jacana. Two minutes later he returned and the young pushed under his wings, then he dropped them again and they foraged around the adult's feet. By 9.33 hours the adult brought the chicks back to the nest, but did not sit on the egg again. At 10.43 hours he walked off the nest, carrying the two



*Above: Stone Curlew at its nest. April 1980.
Below: Openbill Storks nestbuilding. July 1980.
(Photos: Stanley and Belinda Breeden)*



A pair of Painted Storks preening each other during courtship. August 1980.
(Photo: Stanley and Belinda Breedon)

young and did not return to the nest. On inspection the third egg turned out to be infertile.

When in the blind, using close focusing binoculars, we were able to examine the colours of the adult's lappet and beak. The colours are as in figure 1. The lappet is entirely pale

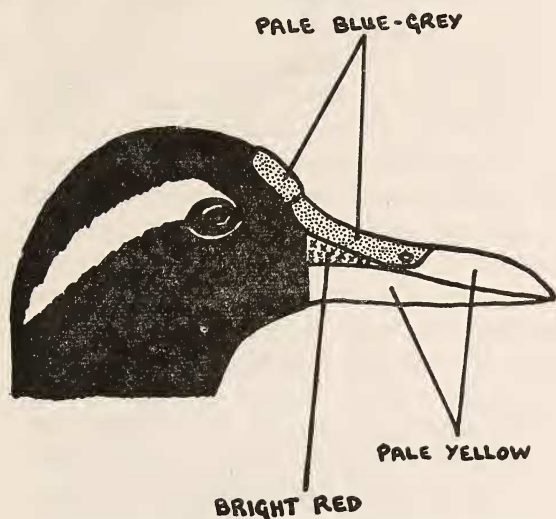


Fig. 1. Head of male Bronzewing Jacana, *Metopidius indicus*.

Beak: pale yellow, duller towards tip. Lappet: pale blue-grey. Triangular area at the base of the upper mandible: bright red.

blue-grey with a triangle of red on the upper mandible. This we found to be the case with all Bronzewing Jacanas we saw right up to the end of January 1981. Most bird books, Ali & Ripley (1969), King *et al.* (1975) and Woodcock (1980) show or describe the lappet as being completely red.

Vanellus indicus

REDWATTLED LAPWING

We found the first nest of this species on a mound in Ram Bund on 19th April 1980. It contained four eggs. We found another nine nests between that date and June 27th but

none after that. A nest we found on May 14th was situated on the baked, hot, bare earth of Hans Sarovar Bund very close to Keoladeo Temple. The shade temperature during that day and the next three fluctuated between 42°C and 45°C. The temperature out in the full sun and on the bare earth must have been considerably higher. On May 14th the nest contained three eggs. The next day there were four. On May 17th we observed the nest from 10.45 hours to 13.00 hours. The birds changed over at the nest at 10.55 hours, at 11.42 and then at 12.42 hours. That meant they sat for periods of 47 and 60 minutes out in the sun. While sitting the birds panted constantly with feathers fluffed out, except when Black Kites wheeled overhead when the birds would sleek their feathers, stop panting and press close to the ground. The relieving bird walked cautiously and slowly all the way from the bund, 150 metres away, over the cracked soil to the nest. The bird on the nest would not rise till its partner was only a few paces away, then it stood up. The new arrival then slipped on to the eggs while the other stood shading them. The relieved partner walked a few paces and then flew to the southern edge of Cirra Bund close to the Keoladeo Temple where there was a small amount of water. The birds arriving at the nest had invariably wet the feathers of their undersides.

The nest we found on June 27th was in babul woodland just north of Ram Bund. It was washed away in a torrential downpour in the early hours of August 11th when virtually the whole Sanctuary was under 15 centimetres of water.

Tringa erythropus

SPOTTED REDSHANK

This species was present in small numbers throughout the winter and spring. The last

one we observed was a bird in breeding plumage seen near Pump D on May 5th 1980.

Rostratula benghalensis

PAINTED SNIPE

The first bird noted was a female near Pump D in Cirra Bund on April 14th 1980. On April 26th there were three pairs in Ram Bund. By May 11th many birds were calling in the green areas in Cirra Bund and Ram Bund. Observed a pair from a blind on May 14th. They were in short green grass growing in about six centimetres of water. The female was busy for about 15 minutes pulling blades of grass together as though building a nest. But no nest was built. Numbers continued to increase until there were about 90 to 100. In one small muddy puddle at the edge of Ram Bund there were 14 of these birds, ten of them females. This was on May 23rd. Once the rains came and the marshes began to fill we saw no more of them. We did not find any nests, though we did search for them.

Recurvirostra avosetta

AVOCET

Saxena (1975) rates the Avocet as rare. During November, December 1979 and January 1980 small numbers, never exceeding 12, stayed for extended periods. The birds invariably came to the muddy pool in the centre of Cirra Bund. By the end of November this area was totally devoid of vegetation and the muddy edges attracted wading birds in large numbers.

Burhinus oedicephalus

STONE CURLEW

On April 25th 1980 Abrar Khan showed us the nest of a Stone Curlew in woodland between the Tourist Bungalow and Ram Bund. The nest was under a piloo bush. In late April

and early May the birds were very vocal throughout the Sanctuary, calling mostly at dusk. We were shown other nests near Cirra Bund (1st May), at Python Point (10th May) and at Bakalaya beside the main road (15th May). All nests contained two eggs and were under piloo or babul shrubs in woodland.

At 5.30 hours on May 13th we noticed the eggs in the nest we were shown on April 25th were pipping. We observed the nest from a previously erected blind from 6.30 onwards. At 8.32 hours the first chick hatched. It soon died. The parents changed over twice between 8.32 hours and 10.32 hours when we left. They did not stay at the nest together. As soon as one arrived the other left. At first the chick was ignored. The sitting parent picked up and ate small fragments of eggshell but the large pieces of shell they tucked under themselves and brooded them together with the young and the second egg. Finally at 9.52 hours one parent flung the empty shells away but only about half a metre from the nest. It did not pick the shells up and carry them away.

On the afternoon of May 15th Abrar Khan showed us yet another nest (i.e. the fifth nest) in woodland near Shanti Kutir that had two pipping eggs. The young hatched that evening.

On May 23rd in the early morning we saw a pair of Stone Curlews with a single downy chick near the main road at the turnoff to Python Point. While we were watching a mongoose trotted close by. Both parents successfully distracted the mammal by doing a dribbling, running broken-wing act.

Larus argentatus

HERRING GULL

On January 16th 1980 two of these gulls were in Cirra Bund near the Keoladeo Temple feeding on a dead fish. This species was not noticed again.

Larus ichthyaetus

GREAT BLACKHEADED GULL

On April 18th 1980 a single individual of this species landed in Ram Bund. On April 19th it was joined by another four which were changing into breeding plumage. On the morning of the 20th they left.

Larus brunnicephalus

BROWNHEADED GULL

Twenty-four Brownheaded Gulls in full breeding plumage landed in the north-west corner of Rauji Bund 1 on the afternoon of April 19th 1980. They left the next morning.

Pterocles exustus

INDIAN SANDGROUSE

Abdulali and Panday (1978) note this species as occasional and Saxena (1975) considers it rare. From January to early June 1980 this species came regularly and in some numbers to drink at Ram Bund and the area round Pump D at Cirra Bund. At first the birds came in twos and threes but by late April they were coming in flocks of 50 or more. On May 15th we saw scores of these sandgrouse feeding in the grassland just north of Kola Dehar.

Treron phoenicoptera

GREEN PIGEON NBR

Green Pigeons were seen in the Sanctuary in some numbers. We found three nests, one on 2nd May, 1980, one on 11th May and one on 25th May. Each was in a babul tree at a height of about 12 metres. Saxena (1975) does not record this species as breeding in the Sanctuary.

Streptopelia sp.

DOVES

Three species, *S. decaocto*, *S. tranquebarica* and *S. senegalensis* breed in Bharatpur. *S. decaocto* and *S. senegalensis* began nesting in late March 1980 and stopped at the end of May. We saw several pairs of *S. tranquebarica* collect and carry nesting material (only around the eastern end of Ram Bund) in April, but we found no nests with either eggs or young in the pre-monsoon period. In late May and June these doves moulted and then began nesting again in the second half of August and continued to October. In the monsoon and post-monsoon breeding *S. tranquebarica* began earlier. We found the first nest on 29th July 1980. The other two species' first monsoon nests were found on 13th August. Many pairs of *S. decaocto* nested in the babul trees in the heronries and we observed several nests from positions where our blinds were set up to photograph egrets or storks. On August 24th a House Crow took eggs from beneath a sitting bird. The crow boldly approached the nest, even though the dove beat at it with its wing. The crow ignored the battering and grabbed an egg. A short time later it returned to take the second egg.

S. decaocto nested at heights between three and six metres while all the nests of *S. senegalensis* we found were in thorny shrubs at heights between one and two metres.

Clamator jacobinus

PIED CRESTED CUCKOO NBR

We first saw this species on June 15th 1980 (we were absent from June 1st to 14th). On the morning of June 24th we observed a pair mating in the trees around Keoladeo Temple. On July 12th a party of five Jungle Babblers was feeding a fledgeling Pied Crested Cuckoo.

The fledgeling was mostly brown, dark above, pale below and already had a well-defined crest. On July 16th along the bund just west of Shanti Kutir we observed a party of five Jungle Babblers feeding two Pied Crested Cuckoos. At dusk the whole party huddled closely together, babbler style, to settle down for the night. Saxena (1975) does not list this cuckoo as a breeding species for Bharatpur.

Cuculus canorus

CUCKOO NR

Neither Abdulali and Panday (1978) nor Saxena (1975) list this species for Bharatpur. Between June 22nd and 26th 1980 there was a great influx of Common Hawk-Cuckoos and Cuckoos into Bharatpur. The majority of them, about 25 of the two species combined, stayed in the babul trees along the western bund of Ram Bund. During these days the Cuckoo was seen and heard frequently.

Cacomantis merulinus

PLAINTIVE CUCKOO NR

This is another cuckoo not previously recorded for Bharatpur. On June 26th 1980 we saw an hepatic female or immature of this species in the woodland immediately to the west of Shanti Kutir.

Centropus sinensis

COMMON CROW-PHEASANT

During the winter and spring this species was largely a scavenger. We saw it feeding on stranded fish, a dead coot, a dead roller, turtles killed by Scavenger Vultures and on one occasion on a Crow-Pheasant which had been killed on the main road.

Otus bakkamoena

COLLARED SCOPS OWL NBR

We first saw this species in a hollow in a huge babul tree on 24th November 1979. The tree was on the eastern side of the main road

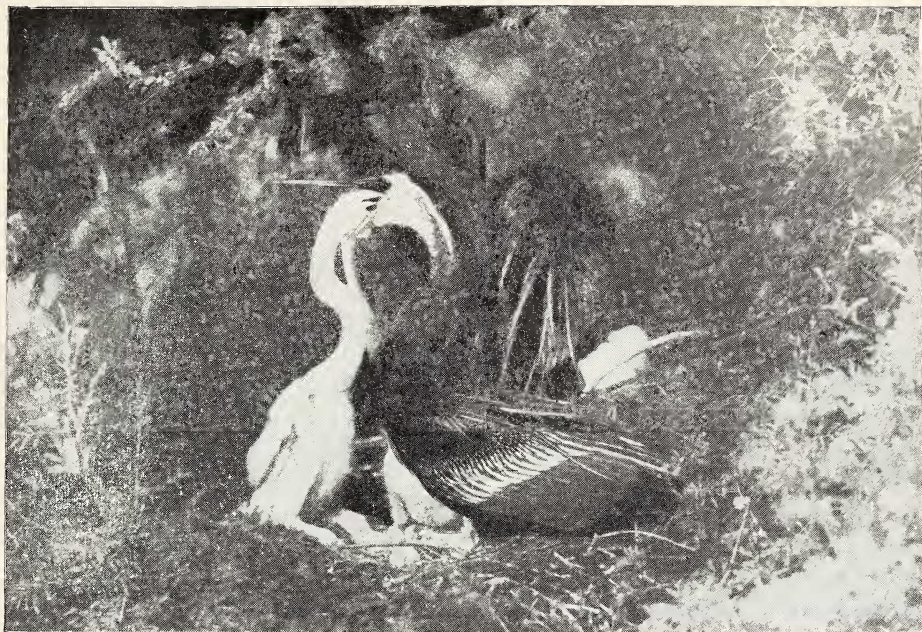
about one kilometre south of Shanti Kutir. The pair had occupied this hollow for some years (Abrar Khan; pers. comm.). We saw the pair regularly until 14th April 1980 when we noticed the hollow had been taken over by bees (*Apis* sp.). On March 3rd 1980 we found a nest in a hollow in a babul tree right beside the Keoladeo Forest Outpost. The hollow, which in previous years had been occupied by rollers (Abrar Khan, pers. comm.), was 5½ metres up in the tree. We first inspected the hollow on March 24th when it contained one egg. On April 1st we found a single young, covered in pure white down and about three centimetres in length. By April 27th the young was sitting at the nest entrance. Between 28th April and 1st May we observed the birds from a blind for several hours each evening. The young would be at the nest entrance by dusk. Shortly after dark one of the parents would come with food at which time the young would clamber out of the nest-hole and sit on a nearby branch. By morning the young was back in the hole, but the parents roosted in the foliage of a neem tree about ten metres from the nest. Of the prey brought to the young by the parents we could identify (from photographs) centipedes, moths and mole-crickets. One of the parents had orange eyes, those of the other were dark brown.

The appearance of the birds during the day, when they were roosting, was very different to what they looked like at night. During the day they sat fluffed out, their eyes were slits and their "ear" tufts very pronounced. At night their heads appeared more rounded with only a vestige of "ear" tufts visible.

Bubo sp.

HORNED OWLS

Three species, *B. bubo*, *B. coromandus* and *B. zeylonensis* occur in the Sanctuary, *B. bubo*



Above: Darter feeding young. September 1980.

Below: Bronzewing Jacana carrying young under its wings. August 1980.

(Photos: Stanley and Belinda Breedon)